inches of water is run, and on top of this the oil. Any impurities settle to the bottom of the water, and are left when the oil is drawn off. In some of the larger refineries these bleachers literally cover acres of ground. The great objection to this method of bleaching is the length of time occupied and the immense space taken up by the bleachers.

It may be asked, What is the object of deblooming oils? So far as I can learn the only object is that they may be used to adulterate the more expensive animal and vegetable oils, such as lard, tallow, linseed, and cottonseed oils.

A mixture of lard oil, 75 per cent at 50 cents a gallon, and debloomed neutral oil, 25 per cent at 13 cents a gallon, will pass for pure lard-oil with anyone but an expert. This fraud may be detected by the lower flashing and burning points of the mixture and by the change in specific gravity from that of pure lard oil. The tests mentioned above may also be applied.

D. T. MARSHALL.

Boston, Mass., April 21.

ASTRONOMICAL NOTES.

[*Edited by George A. Hill.*]

Winnecke's Periodic Comet.

IN No. 3,083 of the *Astronomische Nachrichten* Dr. Haerdtl of Vienna publishes corrected elements for Winnecke's periodic comet, and also an ephemeris extending into next September. The comet will reach perihelion on July 1, be the nearest to the earth on July 9, when it will be only 11 million miles from the earth and attain a brightness 140 times that it had when found by Dr. Spetalerou March 18 last. The comet at the date of discovery was 72 million miles from the earth. The epoch of the ephemeris is for Berlin midnight.

	R.A.			Dec.		
	h	m	s	°	′	
April 30	11	34	23	+	44	2
May 1		32	42		44	8
2		31	4		44	13
3		29	27		44	18
4		27	52		44	22
5		26	20		44	26
6		24	49		44	29
7		23	11		44	31
8		21	52		44	33
9		20	27		44	34
10		19	3		44	35
11		17	41		44	36
12		16	21		44	36
13		15	3		44	35
14		13	46		44	34
15		12	13		44	33
16	11	11	16	+	44	31

Comet Swift.

The following is a continuation of the ephemeris for comet Swift. This comet may prove to be a very interesting one, as the computations made seem to point to the fact that it is moving in a hyperbolic orbit. The observations at the present time do not extend over a sufficient interval to be absolutely sure of this statement, but as the comet is a bright one, it will probably give us a long series, when the question can be definitely settled. We have so few positive cases of comets moving in hyperbolic orbits that this one will receive at the hands of computers a very thorough discussion. The Rev. G. M. Searle, director of the Observatory of the Catholic University at Washington, has computed both hyperbolic and parabolic orbits for this comet. The difference between computation and observation for the middle places in the hyperbolic orbit is zero, while in the parabolic orbit it is + 15″ in longitude and + 7″ in latitude. The following is a continuation of the ephemeris published in No. 481 of *Science*.

	R.A.			Dec.		
	h	m	s	°		
May 8	22	53	10	+	25	28
9		55	58		26	6
10	22	58	45		26	42
11	23	1	30		27	18
12		4	13		27	53
13		6	55		28	28
14		9	35		29	2
15		12	14		29	35
16		14	51		30	7
17		17	27		30	39
18	23	20	1	+	31	11

Comet Denning.

The following is an ephemeris for comet Denning. The epoch is for Berlin midnight:

	B.A.			Dec.		
	h	m	s	°		
May 8	3	11	48	+	55	11
9		15	23		54	57
10		18	54		54	42
11		22	22		54	27
12		25	46		54	12
13		29	7		53	57
14		32	24		53	42
15		35	38		53	27
16		38	48		53	12
17		41	55		52	57
18	3	44	58	+	52	41

MR. PETRIE'S DISCOVERIES AT TEL-EL-AMARNA.

ONLY recently the news reached us of the discovery by the Direction of Exploration in Egypt of the tomb of King Amenhotep IV. (Khu-n-aten) at Tel-el-Amarna; and now, from another quarter, we hear of further important discoveries in the same locality.

The labors of Mr. W. M. Flinders Petrie, who has been working all winter at the excavation of the royal palace of Khu-n-aten, have been rewarded by a most unexpected find, one, indeed, that is unparalleled in the history of archæology. Lying on the ground, tossed in a corner among spoilt blocks of rough granite "Ushabtis," discarded by the artisans who had prepared the king's sepulchral furniture, lay the plaster cast, the mask, of the dead man himself, evidently taken immediately after his death by the sculptors employed to carve his statues. It is in an almost perfect state of preservation.

This extraordinary relic of one of the most interesting figures of antiquity lends unforseen support to the view of the monarch's character suggested in my last article. According to Mr. Petrie, the face thus revealed, as it were, in the flesh, "is full of character. There is no trace of passion in it, but a philosophical calm, with great obstinacy and im-

practicability. He was no fanatic, but rather a high-bred theorist and reformer" How vividly clear do such facts as these make the remote past appear; and what deep meaning they lend to the words of that greatest of word-painters, Ernest Renan: "A giant even placed on the confines of a picture still remains a giant."

The palace has been exhumed and the pavements — beautifully frescoed with tanks and fishes, birds and lotus plants, and almost unique in their style — have come to light; also inlaid walls and splendid columns inscribed with scenes and capped wilh capitals imitating "gigantic jewelry." Their surface was encrusted with brilliant glazes, and the ridges between these were gilt, so that they resembled gems set in gold, the effect thus produced reminding the explorers of the "net-work" of the "Temple of Solomon."

Mr. Petrie was also fortunate enough to come across smaller objects, which have thrown light upon the history of the period. In a neighboring quarry he found the name of Queen Thii, the mother of Khu-n-aten, unaccompanied by that of a king. This fact has given him good ground for the suggestion that she may have governed alone during the minority of her son, who, to all appearances, was only married in the fifth year of his reign, his first child having been born in his sixth year. In the fifth year of his reign the king was still called Amenhotep, as shown in a papyrus found at Gurob, but in his sixth year he appears at Tel-el-amarna as Khu-n-aten; so that the great schism which led to the final rupture between himself and the Theban priesthood must have occurred between those two dates.

Moreover, Mr. Petrie has in his possession a scarab on which Amenhotep is represented in adoration before Aten, the name of Amen having been subsequently erased. This scarab finally settles the question, so often raised, of the identity of the man who bore both names.

Relics of the successors of Khu-n-aten — Ra-Saa-Ka-Khepru, Tut-Ankh-Amen, Aï — were also recovered at Tel-el-amarna, showing them to have resided there after him; and even Hor-em-heb left a block of sculpture inscribed with his "cartouche" in the temple of Aten, probably in the early part of his reign and before his compromise with the conservative Theban party. After that time the site was apparently abandoned and no traces remain of further occupation.

The cuneiform tablets discovered in 1887 were all in storerooms outside the palace, near the house of the Babylonian scribe, which Mr. Petrie identified by finding the "waste pieces of his spoilt tablets in rubbish holes."

A large quantity of Ægean pottery similar to the Mykenæ and Ialysos type was found, of even greater variety of form than that recovered at Gurob. And this as well as the naturalistic character of the frescoes, which Mr. Petrie compares with those of Tiryns and with the gold cups of Vaphio, and the geometrical patterns that decorate some of the columns, which in his opinion closely approach the art of the Mykenæ period, are highly suggestive of Greek intercourse and influence.

The court of Khu-n-aten, in the fifteenth century B.C., must have been a remarkable one. Under the quickening influence of a great mind the foreign conquests of the warlike monarchs of the eighteenth dynasty seem to have been made to yield the richest fruits of peace. A wide-spread intercourse had been established among nations; Phœnicians, Syrians and Mesopotamians, Greeks and Mediterranean Islanders are revealed to us as having come into the Nile valley, bringing along with their commerce their arts, their industries, and various indirect influences. No wonder that the priests of Amon saw with dread and aversion the influx of foreigners who, encouraged by the evident cosmopolitanism of their king, bid fair to revolutionize the ancient traditions of their venerable land and to remove the narrow boundaries of Egyptian conservatism. S. Y. STEVENSON.

THE ROLLING OF SHIPS.[1]

ONE fact that often strikes the thoughtful traveller by sea is that, notwithstanding the great and numerous improvements of recent years which have made life on shipboard pleasant and luxurious, little or nothing has been done to steady a vessel when she meets with waves that set her rolling heavily from side to side. The tendency seems to be rather in the direction of increased than of diminished rolling; for the steadying influence of sails, which makes the motion so easy and agreeable in a sailing ship, is fast disappearing in large steamers. Masts and sails add appreciably to the resistance of large fast steamers; so they have been cut down in size year by year till such fragments of sail as still remain are so small compared with the size of the ship as to retain little power to reduce rolling.

Shipowners and seamen do not show much sympathy with the discomfort and misery that rolling causes to most passengers. They perhaps get anxious about an occasional vessel that acquires the evil reputation of being a bad roller, because passengers may be frightened away and the receipts fall off in consequence; but beyond wishing, or attempting, to deal with abnormal cases, nothing seems to be thought of. Rolling is considered incurable, or as not of sufficient importance to trouble about. Yet there is nothing which would contribute so directly to the comfort of landsmen at sea, or do so much to change what is for many misery and torture into comfort, as to check and reduce as far as possible the rolling proclivities of ships.

The laws which govern rolling are now well understood, and it is strange that this knowledge has not enabled an effective means of control to be devised. What is stranger still is that well-known means of mitigating rolling — such as the use of bilge keels — are employed in but very few cases. A ship rolls about a longitudinal axis which is approximately at her centre of gravity, and the rolling is practically isochronous at moderate angles in ordinary ships. The heaviest rolling occurs when the wave-period synchronizes with the natural period of oscillation of the ship. Many vessels are comparatively free from rolling till they meet waves of this period, and if such meeting could be avoided, excessive rolling could be prevented. Some vessels have periods as long as fifteen to eighteen seconds for the double oscillation, and as these would require to meet with waves 1,300 to 1,500 feet in length, in order to furnish the conditions of synchronism, it is seldom that they suffer from heavy or cumulative rolling. Such waves are, however, not rare in the Atlantic.

The limits of heavy rolling are fixed, of course, by the resistance offered by the water and air to the transverse rotation of the ship, which is very great because of the large areas that directly oppose motion in a transverse direction. But for this resistance, and the condition that rolling is only isochronous within moderate angles of inclination, a few waves of the same period as that of a ship would capsize her.

[1] From Nature.